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FIGURES

1. INTRODUCTION

This Attachment was prepared in support of Excelsior Mining Arizona, Inc.'s (Excelsior's) Underground Injection Control (UIC) Permit application to the United States Environmental Protection Agency (USEPA). Excelsior is applying for an area Class III UIC permit to install a wellfield for in-situ recovery (ISR) of copper at the Gunnison Copper Project (Project), located in Cochise County, Arizona. The wellfield will consist of Class III delivery (injection) and recovery wells, hydraulic control wells, and observation wells. A sulfuric acid solution will be delivered to the copper oxide deposit, and pregnant leach solution (PLS) will be pumped from the recovery wells and routed to a solvent extraction/electrowinning (SX-EW) plant where copper cathode will be produced.

This attachment identifies the proposed Area of Review (AOR) as required by §146.6.

The AOR for the wellfield described in this Attachment was determined by the construction of a numerical groundwater model to determine the "zone of endangering influence", which is described in §146.6(a)(1)(ii) as follows:

> *. . .the project area plus a circumscribing area the width of which is the lateral distance from the perimeter of the project area, in which the pressures in the injection zone may cause the migration of the injection and/or formation fluid into an underground source of drinking water.*

The intent of the AOR requirement is to protect underground sources of drinking water (USDWs). UIC regulations require the permitting authority to determine, within an AOR, whether a proposed injection operation has a potential for contaminating underground sources of drinking water through wells, faults, or other pathways that penetrate an injection zone. The AOR, also known as the zone of endangering influence, is the area surrounding an injection well or injection well pattern in which the pressure change in the injection zone, resulting from high pressure injection, is great enough to make possible the migration of fluids out of the injection zone and into an underground source of drinking water (Engineering Enterprises, 1985).

2. PROJECT DESCRIPTION

2.1 Location

The Project is a proposed copper mine that will be located in Cochise County, Arizona, approximately 62 miles east of Tucson and 17 miles west of Willcox (Figure A-1). The location is along Interstate 10 on the southeastern flank of the Little Dragoon Mountains, in the Cochise Mining District. The deposit was previously known as “the I-10 Deposit” (Kantor, 1977).

The Project is located in a district where copper, zinc, silver and tungsten mining have occurred since the 1880s. The deposit was discovered in the 1960s, when exploratory drilling was conducted following detection of a magnetic anomaly. Several million tons of low-grade acid soluble copper mineralization were identified by early 1974. Since that time, extensive exploration has occurred, including 55 diamond coreholes drilled between 2010 and 2014 (M3, 2014 and 2016).

With the exception of mineral exploration and related investigations, past use of the site has been limited to livestock grazing. Interstate 10 crosses the Project from southwest to northeast; otherwise the land is vacant, as shown on a recent aerial image of the site (Figure A-2). No mining has occurred at the Project site. However, the Project does fall within an active mining district. The Johnson Camp Mine (JCM), owned by affiliate company Excelsior Mining JCM Inc. is located 1.5 miles to the northwest.

2.2 Mining Method

The Project consists of a copper mine that will encompass an area of approximately 700 acres. Within this area, copper will be extracted using the ISR method from oxide mineralization located along fractures within the deposit. The wellfield will have an area of approximately 192 acres (Figure A-3).

The ISR method involves injecting low-pH barren solutions (raffinate) into the orebody through an array of injection wells and extracting copper-bearing solutions (pregnant leach solution or PLS) though an array of interspaced recovery wells.

ISR is the preferred mining method for the deposit due to the fractured nature of the host rock, the presence of water-saturated joints and fractures within the ore body, and copper mineralization that preferentially occurs along fracture surfaces. The in-situ method avoids the challenges of open pit mining in an area with basin fill overburden thickness exceeding 400 feet (M3, 2014) and greatly simplifies reclamation and closure because there will be no open pit, waste rock stockpiles, or tailings impoundments.

2.3 Life of Mine and Proposed Operation Schedule

The anticipated operational life of the Project is 23 years. Operations will begin upon acquisition of all necessary permits. The target start date is mid to late 2017.

Mine operations will be implemented in stages:

- Stage 1 — Years 1 – 10 — 25 million lbs Cu per year
- Stage 2 — Years 11 – 13 — 75 million lbs Cu per year
- Stage 3 — Years 13 – 20 — 125 million lbs Cu per year
- Post production — Years 20 – 23 — -

Multiple mining blocks will be active during each stage. As mining of individual blocks is completed, the mining operations will be followed by a rinsing period while mining proceeds to subsequent blocks. The final rinsing period for the last mining block is anticipated to be completed by year 23. A more detailed description of the rinsing for closure strategy is provided in Attachment H-2.

2.4 Process Description and Layout

The Project will consist of a network of injection wells used to deliver acidified raffinate to the ore horizon, enabling it to contact the mineralization within the fractures, and dissolve the metal while passing through the ore body. Injection and recovery wells will be interspaced approximately 71 feet apart in an alternating and repeating pattern throughout the well field. In addition, the ISR wellfield will be bounded in downgradient areas by a series of hydraulic containment wells that will provide net positive pumping for the Project. Hydraulic containment will be maintained throughout the life of the Project.

At the surface, copper will be removed from the extracted pregnant leachate solution (PLS) at a solvent extraction-electrowinning (SX-EW) plant (initially at the JCM and later at the Project site) where pure copper cathode will be produced. After processing, the fluid will be recycled to the wellfield to begin the leaching cycle again.

The locations of the Gunnison site facilities are shown on Figure A-3. Impoundments and the SX-EW plant at the JCM (owned by an affiliate company) will also be used to store and process Project solutions[1].

Additional information regarding the mining processes is included in Attachments H and K.

[1] JCM operates under Aquifer Protection Permit P-100514. There will be no ISR operations at JCM.

3. HYDROGEOLOGIC AND OPERATIONAL CONSIDERATIONS

Control of injected solutions, and thus the delineation of AOR, will rely on the wellfield's site-specific hydrogeologic characteristics and operational controls. Therefore, these considerations are presented in this section. Site-specific characteristics were considered in determining the amount of engineered and operational containment that is needed for effective operation of the wellfield. These elements constitute the Best Available Demonstrated Control Technology (BADCT) proposed in Excelsior's Aquifer Protection Permit Application for the wellfield.

3.1 Site Specific Characteristics

Site specific factors at the Gunnison site are favorable for maintaining control of the leach solution. Three factors of particular note are:

- Absence of an aquifer (mostly unsaturated basin fill) overlying the zone of injection
- Absence of an aquifer (low hydraulic conductivity sulfide ore body) underlying the zone of injection
- Large attenuation capacity of limestone downgradient of the zone of injection

Each of these characteristics is discussed in the sections below.

<u>3.1.1 Unsaturated Basin Fill</u>

The absence of a significant thickness of saturated basin fill overlying the proposed in-situ wellfield is a particularly favorable site specific characteristic for maintaining discharge control. The basin fill overlying the injection zone does not meet the definition of an underground source of drinking water (USDW) according to 40 CFR §144.3. Occurrences of saturated basin fill are thin and isolated above the ore deposit; thus, it does not contain a "sufficient quantity of groundwater to supply a public water system." Furthermore, drawdown as a result of ISR operations (as discussed in Attachment A-2) may reduce, and possibly eliminate the saturated basin fill.

More information regarding occurrences of groundwater in basin fill is provided in Attachments D and S.

3.1.2 Low Conductivity Sulfide Zone

The bedrock sulfide zone is located beneath the zone of injection (i.e. the oxide zone). The sulfide zone is less fractured than the oxide zone. Excelsior conducted two aquifer tests, at NSH-014B and NSH-025, in the sulfide zone in 2015. Both tests were terminated before the scheduled end because the wells were pumped dry. A complete analysis of the aquifer testing data is provided in Attachment A-3. Drawdown in NSH-014B was 442 feet after 1.5 hours at a pumping rate of one gpm. The estimated hydraulic conductivity (K) for NSH-014B is .001 ft/day. Drawdown in NSH-025 was 220 feet after one hour with pumping at a rate of four gpm. The estimated K in NSH-025 is 0.1 ft/day. Both K values are very low. Because of its low hydraulic conductivity, the sulfide zone is considered not feasible as an aquifer for a public water supply, and it provides a site specific control on the vertical migration of injected solutions.

3.1.3 Attenuation Capacity of Limestone

The regional hydraulic gradient (Figure A-4) indicates that if hydraulic control around the in-situ wellfield were to be lost, the PLS would migrate in an eastward direction. As shown on Figures A-5 and A-6, the Escabrosa and Horquilla limestones (shown as Paleozoic/Mesozoic undivided on the cross sections) are located east of the mineralized rocks. These formations are predominantly composed of calcite with some minor subordinate clastic and dolomitic beds in the Horquilla and a dolomitic layer at the base of the Escabrosa (Cooper and Silver, 1964).

As discussed in Attachment H-2, geochemical modeling by Duke HydroChem demonstrates that the attenuation capacity of these limestones is a significant discharge control. According to Duke HydroChem, "the neutralization reaction occurs very quickly with pH of the solution reaching circumneutral within approximately one day. As the pH approaches circumneutral, metal concentrations are controlled by precipitation of secondary mineral phases and through sorption on the surface of secondary hydrous ferric oxide (HFO) precipitates."

3.2 Operational Controls

3.2.1 Hydraulic Gradients

Excelsior's strategy for controlling solutions is to install hydraulic control (HC) wells that will generate overlapping cones of depression, where needed, around the perimeter of the wellfield.

Numerical groundwater flow (MODFLOW) and particle track (MODPATH) modeling of the Project (Attachment A-2) have shown that this approach will be successful in providing hydraulic capture and containment of the solutions. The model was constructed using aquifer parameters that were consistent with the results of numerous long-term aquifer tests conducted at the site (Attachment A-3). The model simulations were based on the operating conditions over the duration of the Project, whereby the total rate of pumping from the in-situ recovery wells and hydraulic control wells will be adjusted and maintained to exceed the total rate of lixiviant injection.

In accordance with the model findings, Excelsior will install hydraulic control wells and observation wells around the eastern, southern, and northern boundaries of the wellfield (Figure A-7). The well locations are approximate; the actual locations will be determined by site-specific conditions and the progression of in-situ mining activities. Installation and startup of the hydraulic control wells will proceed approximately concurrently with the development and startup of each in-situ wellfield block. The hydraulic control wells will be installed and operated downgradient from areas of the in-situ wellfield as those areas become active, as indicated by the Figure 45 in the Hydrogeologic Model Report (Attachment A-2).

The hydraulic control wells and observation wells will be screened (or open) at approximately the same elevations as the injection and recovery wells. The hydraulic control wells will supply water to the site and generate cones of depression which will provide an outer hydraulic barrier around the in-situ leaching operations. The observation well pairs will be located outside the hydraulic control wells and will be used to monitor the inward hydraulic gradients generated by the hydraulic control wells. Numerical modeling has shown that hydraulic control wells are not needed on the western side of the wellfield due to the higher natural west-to-east hydraulic gradient (as show on Figure A-4), with the exception of two locations where modeling indicated a localized southward flow direction. Hydraulic capture is discussed further in Attachment A-2.

3.2.2 Injection Flow

The actual field conditions encountered during operation will determine the pumping and injection rates and the net pumping differential required to maintain an inward hydraulic gradient. Compliance with a specific net volume or net rate of extraction in excess of injection is not proposed as a permit condition, as it is expected to vary depending on the block(s) being mined and rinsed.

Excelsior proposes to operate the wellfield such that:

- the total volume of injected fluids will not exceed the total volume of extraction from recovery wells and hydraulic control wells based on a 30-day rolling average;
- an inward hydraulic gradient will be maintained around the active portions of the in-situ wellfield, as measured in observation wells located near the hydraulic control wells (Figure A-7).

Anticipated average and maximum injection volumes are provided in Attachment H.

3.2.3 Injection Pressure

Excelsior proposes a conservative maximum injection pressure gradient of 0.75 psi/foot to prevent hydraulic fracturing and propagation of existing fractures, based on fracture gradient testing conducted in 2015. Details of the testing methodology and analyses are provided in Attachment I-2.

3.2.4 Borehole Abandonment

ADEQ's Mining BADCT Guidance Manual (2004) and 40 CFR §144.55 identify plugging and abandonment of potential conduit wells and boreholes as a "corrective action" under UIC and as an appropriate BADCT element for ISR with deep well injection projects. Because neither the basin fill above the oxide ore body nor the sulfide zone underlying it meet the definition of an USDW according to 40 CFR §144.3, well and borehole abandonment is not proposed as a permit requirement or an element of BADCT. Some existing coreholes within the wellfield may be used as water level monitoring points within the wellfield.

Excelsior may opt to plug and abandon some wells and coreholes in order to control the flow of PLS in the shallow bedrock. In these cases, plugging or abandonment of the boreholes will be conducted using a method consistent with the "Standard Abandonment Method" in the ADWR Well Abandonment Handbook (2008) and included in Attachment Q.

3.2.5 Well Construction

Wells installed at the Gunnison Copper Project will include injection, recovery, hydraulic control, observation wells and point of compliance (POC) wells. With the exception of the POC wells, these wells will be constructed to meet Class III requirements[2]. Several possible well designs, including varying diameters, are planned for the injection, recovery, and hydraulic control wells. The injection, recovery, and hydraulic control wells are proposed to have open-hole completions within the ore body, which ranges from approximately 400 to 800 feet in thickness. Observation wells and POC wells will be constructed with well screen. Additional details are provided in Attachments L and M.

3.2.6 Mechanical Integrity Testing

After well construction is complete, Part 1 of the UIC mechanical integrity testing requirement will be addressed by the following method or another suitable method approved by ADEQ and EPA: A packer will be installed immediately above the bottom of the cased interval, and the casing will be completely filled with water. A hydraulic pressure equal to or above the maximum

[2] POC wells will be located just outside the proposed Area of Review delineated in the Underground Injection Control Application, and therefore Class III requirements do not apply.

allowable wellhead injection pressure will be applied. The test will be conducted for a minimum of 30 minutes. The well will be considered to have passed if there is less than a five (5) percent change in pressure during the 30 minute period. Part 1 mechanical integrity will be demonstrated before a Class III well is put into service and when there is reason to suspect a well failure.

If a packer completion is used (as shown in Attachment M), mechanical integrity testing of the tubing-casing annulus pressure will be conducted according to UIC requirements.

Part 2 mechanical integrity testing addresses vertical channels adjacent to the well bore; it will not be conducted because the basin fill that overlies the injection zone is not an underground source of drinking water.

Additional information regarding Mechanical Integrity testing is provided in Attachment P.

3.2.7 Wellfield Closure Strategy

Closure of the wellfield will include rinsing to remove residual PLS and well abandonment, as discussed in the sections below. The closure strategy consists of the following elements:

- Rinsing
- Well plugging and abandonment
- Report preparation

3.2.7.1 Rinsing

A rinsing closure strategy is proposed for the wellfield. After copper recoveries drop below the economic cutoff, ISR in a given production block will be deemed complete and the block will be rinsed using fresh groundwater until applicable water quality standards are met. A 3-step rinsing strategy, based on geochemical modeling by Duke HydroChem (Attachment H-2):

1. Rinse three (3) pore volumes (based on a 3% fracture porosity of the ore body)
2. Rest
3. Rinse two (2) pore volumes

Step 1 will result in a mix of 5% PLS and 95% groundwater after rinsing with three pore volumes, based on core tray and column testing documented in a rinsing report by Clear Creek (Attachment H-2). The mechanism by which solute is removed during Step 1 is advective flow, i.e. flushing of the fractures.

Step 2 allows the solution to be neutralized as silicate and carbonate minerals are altered. Solute concentrations will be controlled by precipitation of secondary minerals and complexation (sorption) on hydrous ferric oxide surfaces. The resting period will continue until pH of the resident solution is circumneutral and all regulated constituents are at or below AWQSs. The geochemical model results indicate that these conditions would be attained after a resting period of approximately one year (Attachment H-2).

Step 3 is a final rinse of two pore volumes. This step will facilitate removal of any constituents that might still be present at or near regulatory limits. Similar to Step 1, the solute removal mechanism of Step 3 is flushing.

Monitoring of groundwater from the mining block during the rinsing process will be conducted to evaluate the effectiveness of the rinsing. Samples will be collected from approximately 10% of the wells within the mining block after each step. Analyses will be conducted for APP-regulated metals (dissolved), sulfate, TDS, pH, and specific conductivity.

Hydraulic control will be maintained and monitoring of POC wells will continue, as required under the APP, until closure goals are achieved.

Prior to well plugging and abandonment of a mining block, a report will be submitted to ADEQ documenting the rinsing. The report will include documentation of the volumes of rinse water injected and recovered, results of laboratory analytical analyses after Steps 1, 2, and 3, and a recommendation will be provided on whether additional rinsing is needed. Well plugging and abandonment will not commence without approval from ADEQ.

3.2.7.2 Well Plugging and Abandonment

After the goals of the rinsing are met, the wells that are classified as Class III injection wells under the UIC regulations, will be plugged and abandoned, as required under 40 CFR 146.10. This requires that wells be abandoned in such a way that fluid will not move into underground sources of drinking water. In addition to the federal requirements, Arizona Administrative Code R12-15-816 contains abandonment requirements and additional guidance is provided in the Arizona Department of Water Resources Well Abandonment Handbook (AWDR, 2008). Well plugging and Abandonment procedures will be conducted according to the methodology in Attachment Q.

4. AREA OF REVIEW

4.1 Approach

According to Title 40 §146.6:

> *The area of review for each injection well or each field, project or area of the State shall be determined according to either paragraph (a) or (b) of this section. The Director may solicit input from the owners or operators of injection wells within the State as to which method is most appropriate for each geographic area or field.*
>
> *(a) Zone of endangering influence.*
>
> *(1) The zone of endangering influence shall be:*
>
> *(i) In the case of application(s) for well permit(s) under §122.38 that area the radius of which is the lateral distance in which the pressures in the injection zone may cause the migration of the injection and/or formation fluid into an underground source of drinking water; or*
>
> *(ii) In the case of an application for an area permit under §122.39, the project area plus a circumscribing area the width of which is the lateral distance from the perimeter of the project area, in which the pressures in the injection zone may cause the migration of the injection and/or formation fluid into an underground source of drinking water.*
>
> *(2) Computation of the zone of endangering influence may be based upon the parameters listed below and should be calculated for an injection time period equal to the expected life of the injection well or pattern. The following modified Theis equation illustrates one form which the mathematical model may take.*

$$r = \left(\frac{2.25\, KHt}{S10^{x}} \right)^{1/2}$$

where:

$$X = \frac{4\pi KH \left(h_w - h_{bo} \times S_p G_b \right)}{2.3Q}$$

- *r=Radius of endangering influence from injection well (length)*
- *k=Hydraulic conductivity of the injection zone (length/time)*
- *H=Thickness of the injection zone (length)*
- *t=Time of injection (time)*
- *S=Storage coefficient (dimensionless)*
- *Q=Injection rate (volume/time)*
- *hbo=Observed original hydrostatic head of injection zone (length) measured from the base of the lowermost underground source of drinking water*
- *hw=Hydrostatic head of underground source of drinking water (length) measured from the base of the lowest underground source of drinking water*
- *Sp Gb=Specific gravity of fluid in the injection zone (dimensionless)*
- *π=3.142 (dimensionless)*

The above equation is based on the following assumptions:

(i) The injection zone is homogenous and isotropic;

(ii) The injection zone has infinite area extent;

(iii) The injection well penetrates the entire thickness of the injection zone;

(iv) The well diameter is infinitesimal compared to "r" when injection time is longer than a few minutes; and

(v) The emplacement of fluid into the injection zone creates instantaneous increase in pressure.

(b) Fixed radius.

(1) In the case of application(s) for well permit(s) under §122.38 a fixed radius around the well of not less than one-fourth (1/4) mile may be used.

(2) In the case of an application for an area permit under §122.39 a fixed width of not less than one-fourth (1/4) mile for the circumscribing area may be used.

In determining the fixed radius, the following factors shall be taken into consideration: Chemistry of injected and formation fluids; hydrogeology; population and ground-water use and dependence; and historical practices in the area.

(c) If the area of review is determined by a mathematical model pursuant to paragraph (a) of this section, the permissible radius is the result of such calculation even if it is less than one-fourth (1⁄4) mile.

Excelsior's AOR method is based on the mathematical approach (a) described above. The AOR is determined by a mathematical model, and thus, section (c) above applies. An AOR radius of less than ¼ mile is permissible using this method.

4.2 Numerical Model

Documentation of the mathematical model used to delineate the AOR is provided as Exhibit A-2. Excelsior also used this model in support of an Aquifer Protection Permit (APP) application that was submitted to the Arizona Department of Environmental Quality (ADEQ).

The numerical groundwater flow model was constructed by Clear Creek using a number of extensive datasets, including detailed mapping of fracture intensity, which is key to groundwater flow in the Project area. MODFLOW-NWT (*A Newton Formulation of MODFLOW 2005*, Niswonger, 2011), was the numerical code selected to simulate groundwater flow in the Project area. MODFLOW-NWT an updated version of the 3D finite-difference code based on the widely used United States Geological Survey (USGS) model program MODFLOW (McDonald and Harbaugh, 1988).

The governing equation for MOFLOW is the partial-differential equation of groundwater flow (McDonald and Harbaugh, 1988):

$$\frac{\partial}{\partial x}\left(Kxx\frac{\partial h}{\partial x}\right)+\frac{\partial}{\partial y}\left(Kyy\frac{\partial h}{\partial y}\right)+\frac{\partial}{\partial z}\left(Kzz\frac{\partial h}{\partial z}\right)+W=Ss\frac{\partial h}{\partial t}$$

Where:

- Kxx, Kyy, and Kzz are values of hydraulic conductivity along the x, y, and z axes (feet/day),
- H is the potentiometric head (feet)
- W is the volumetric flux per unit or recharge rate ($time^{-1}$)
- Ss is the specific storage of the aquifer material ($foot^{-1}$)
- t is time (days).

The MODFLOW NWT code (Newton Raphson formulation), includes an upstream weighting package (UPW), which simulates a continuous hydraulic conductivity field from saturated to unsaturated model cells allowing for smoother representation of wet and dry model cells. This is done by implementing a continuous pseudo-soil function representation for head from dry to wet cell conditions, as opposed to the discrete dry/wet approach used in previous versions of

MODFLOW. This approach allows for a smoother representation of saturation conditions, more accurately reflecting the aquifer rewetting and drying conditions.

The model's finite difference grid consists of 209 rows, 209 columns, and 7 layers for a total of 305,767 calculation cells. Of those, 173,523 cells are active. Cells range from 300 feet square to 75 feet square in the area of the ore reserve. The model domain covers an area of 87.8 square miles and encompasses the major hydrologic drainages in the vicinity of the Project. Additional details regarding the data inputs, boundary conditions, recharge, hydraulic properties, model calibration, hydraulic containment, and particle tracking are provided in the Groundwater Model Report (Attachment A-2).

4.3 AOR Delineation

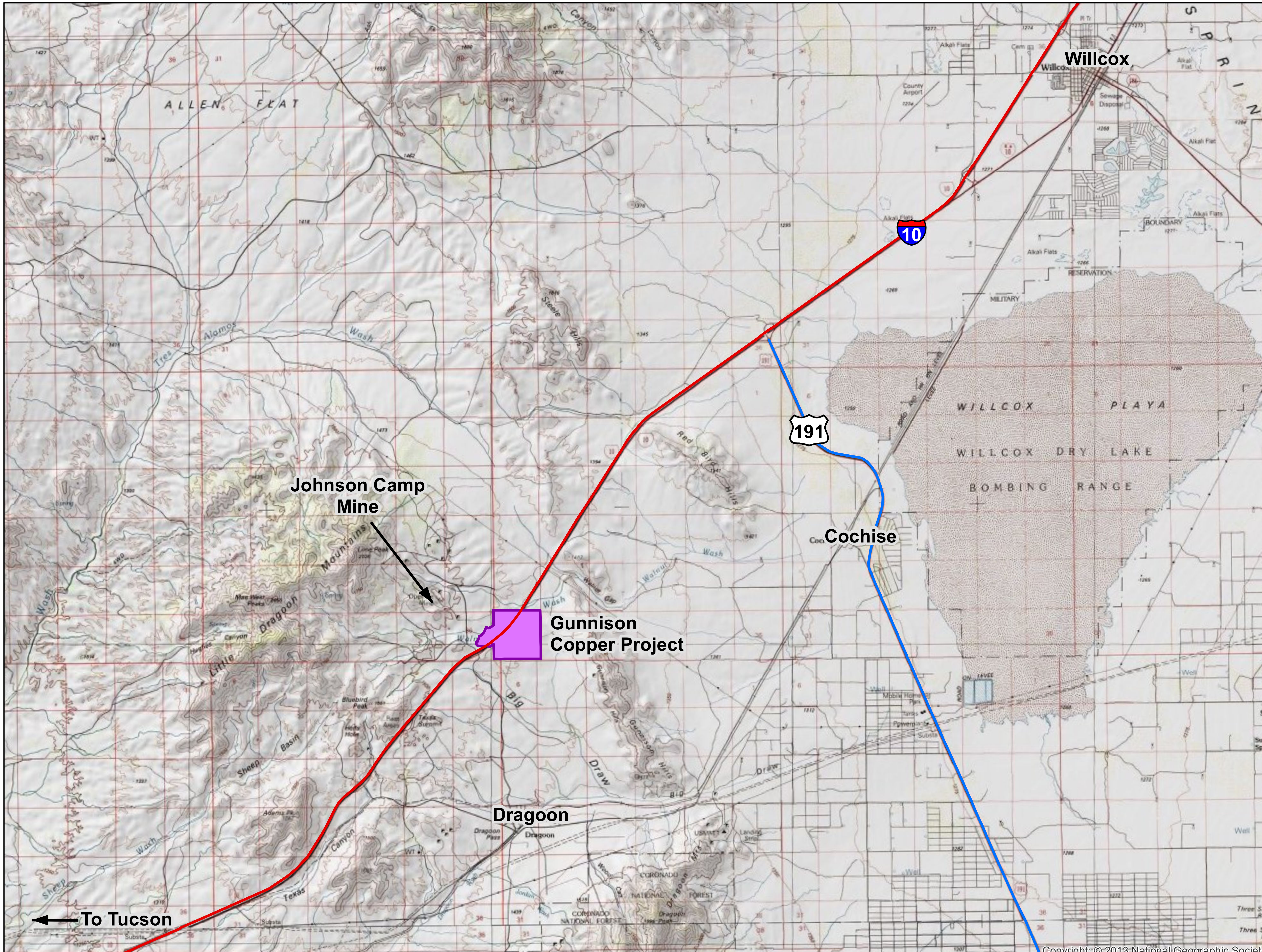
Due to geologic and hydrogeologic heterogeneities, the model does not support a fixed radius around the wellfield. Instead, the proposed distance of the AOR from the wellfield boundary varies and is based on the existing hydraulic gradients and model outputs showing areas of influence of the hydraulic control wells on the east side of the wellfield. The proposed AOR encompasses 332 acres. The proposed AOR boundary, shown on Figure A-7, is described as follows:

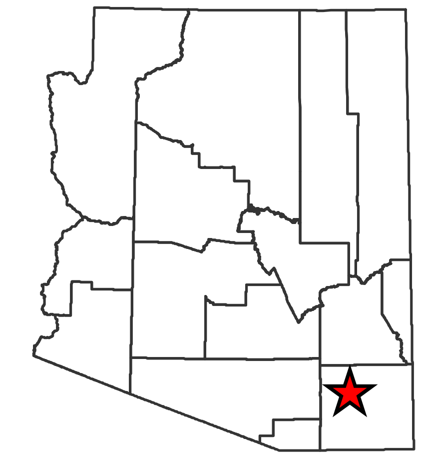
Western Boundary of AOR - Groundwater flows from the west into the wellfield along the western boundary. The proposed AOR boundary is coincident with the property boundary, which is approximately 100 feet from the nearest injection wells. Due to the high eastward hydraulic gradient, injection flows cannot overcome the eastward flow direction.

Eastern Boundary – (from the southeast corner of the AOR to the northern extent): The AOR extends approximately 1,200 feet to the east of the outermost wells in the ISR wellfield. The eastern side of the AOR is based on the maximum capture zones for hydraulic control wells on the east side of the wellfield (Figure 63 in Attachment A-2). The hydraulic control wells serve as a barrier to contain pollutants, and the hydraulic control wells' areas of influence, which are critical to pollutant containment, are also considered to be within the AOR along the eastern boundary. The areas of influence of the hydraulic control wells were identified on vector plots produced by the numerical model (Figures 60, 61, and 62 in Attachment A-2).

Southern Boundary of AOR: The AOR on the south side of the wellfield coincides with the property boundary. Containment along the south edge of the wellfield is primarily provided by the regional hydraulic gradient, which is parallel to the property boundary. Hydraulic containment wells along this boundary provide additional containment, as shown by velocity vectors (Figures 60, 61, and 62 in Attachment A-2). Due to the natural groundwater flow direction in this area, the AOR does not need to extend out to the full area of influence of the hydraulic control wells. On the west (upgradient) side of the wellfield, eastward flow gradients provide adequate containment, so, with the exception of HC-29 and HC-30 there are no hydraulic containment wells on the west side of the wellfield. Hydraulic containment wells HC-

29 and HC-30 were sited due to small excursions from the wellfield identified in the model (Attachment A-2). The AOR coincides with the western property boundary to the west.





Legend

Gunnison Copper Project

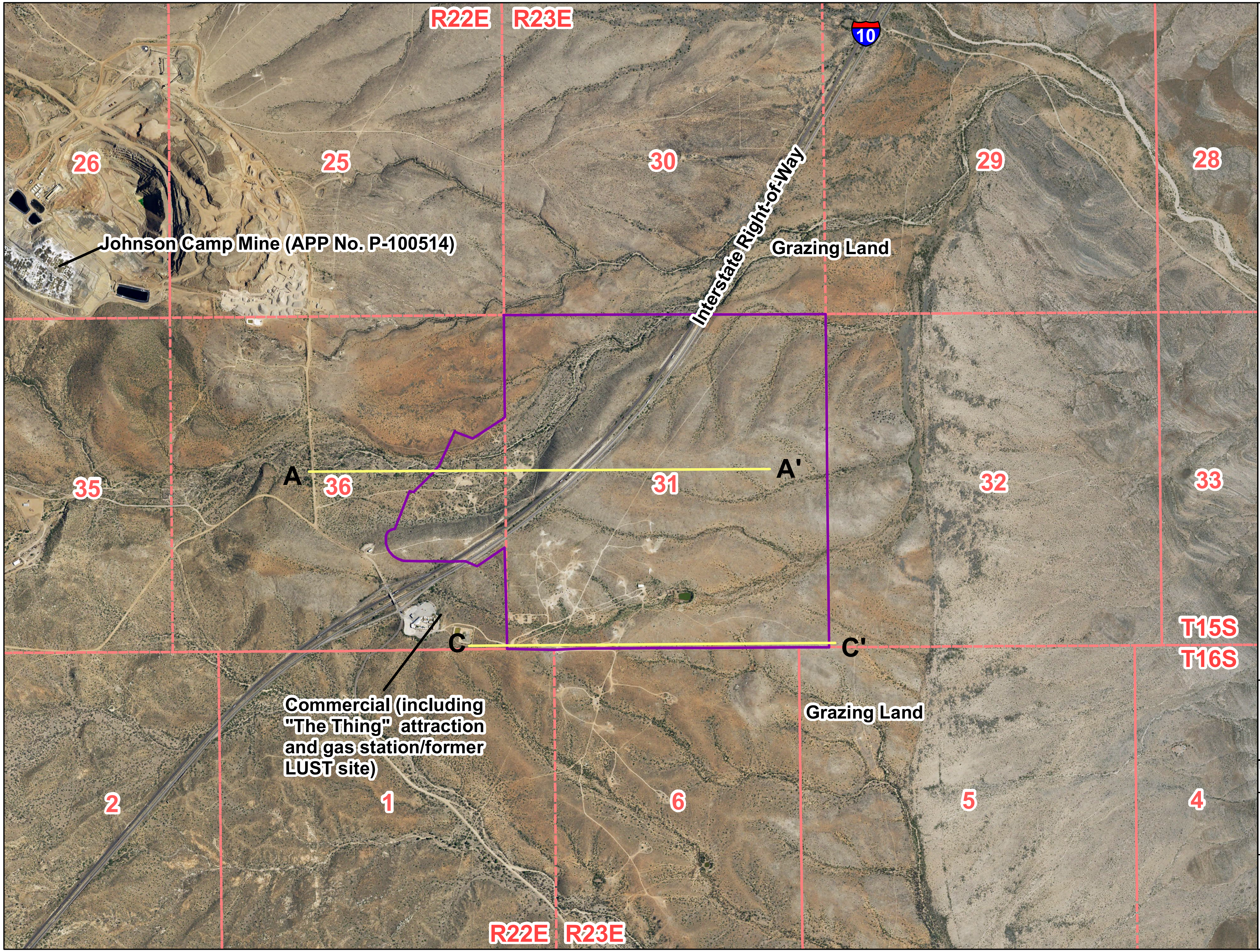
0 1 2 4
Miles

Excelsior Mining Arizona, Inc.
Gunnison Copper Project
UIC Permit Application
February 2016

Date	File ID
1/19/16	373-008D

CLEAR CREEK ASSOCIATES

FIGURE A-1
Project Location



Legend

- Gunnison Copper Project
- Cross Section Line

0 750 1,500 3,000
Feet

Excelsior Mining Arizona, Inc.
Gunnison Copper Project
UIC Permit Application
February 2016

Date	File ID
1/19/16	373-014A

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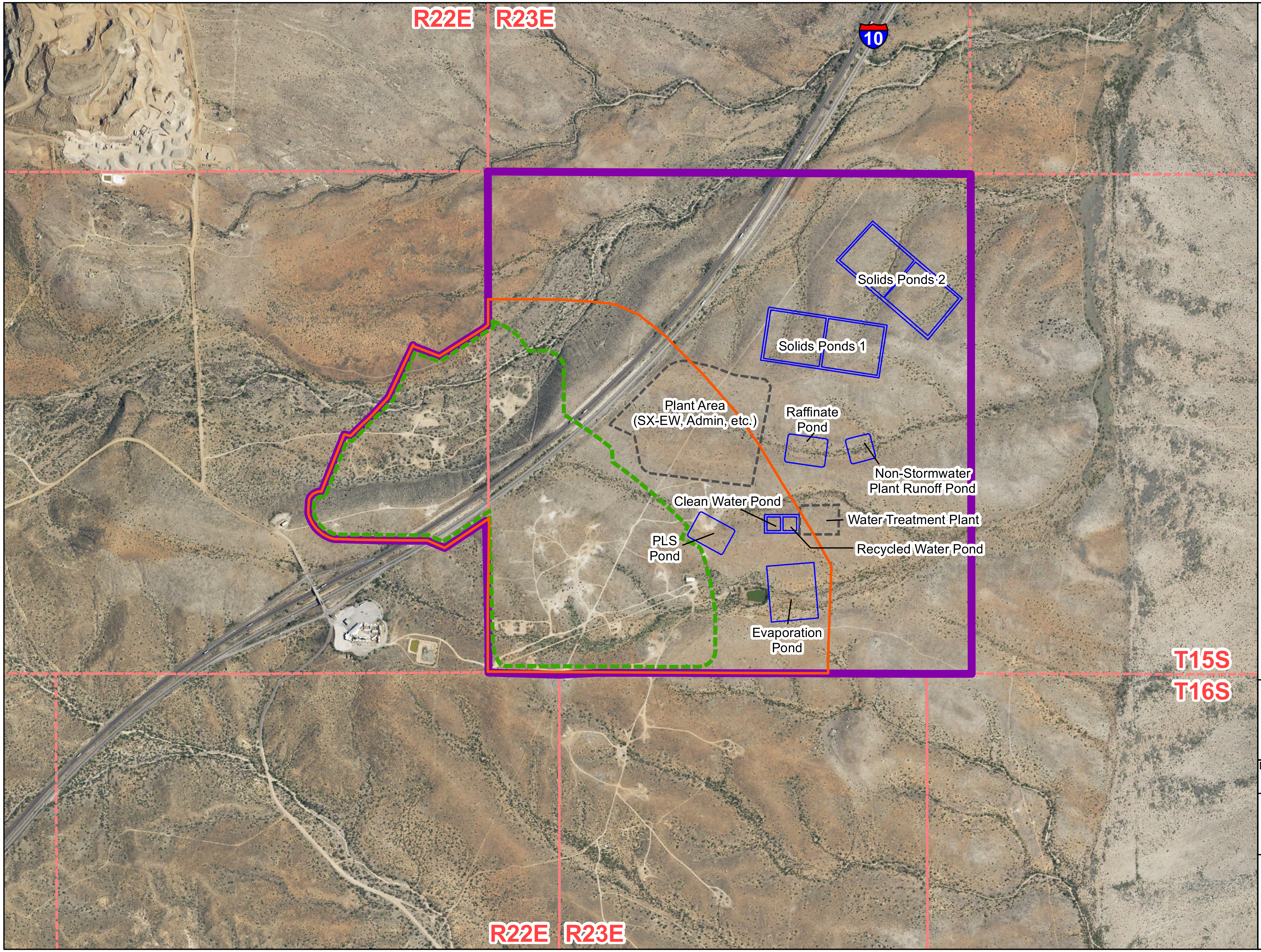
FIGURE A-2
Current Land Use



Legend

- Gunnison Copper Project
- Wellfield
- Other Mine Structures
- Area of Review
- Pond

0 500 1,000 2,000
Feet

Excelsior Mining Arizona, Inc.
Gunnison Copper Project
UIC Permit Application
February 2016

Date	File ID
1/21/18	373-013B

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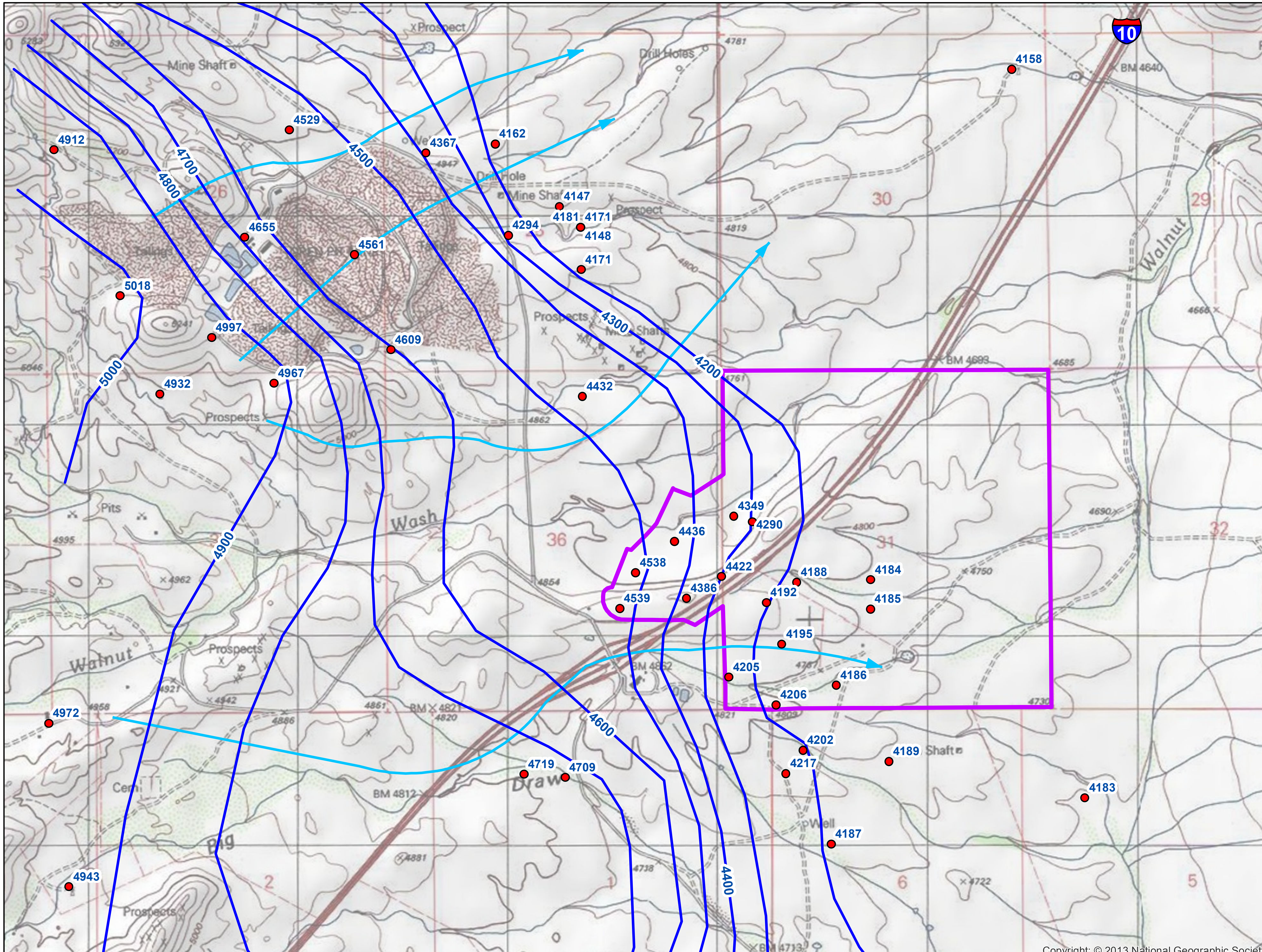
FIGURE A-3
Facility Site
Plan



Legend

- Well - Groundwater Elevation (ft amsl)
- Groundwater Elevation (ft amsl) 100 ft contour interval
- Groundwater Flow Direction
- Gunnison Copper Project

Site water levels are from June 2015
All other water levels are the most recent data from 1949 to the present

0 750 1,500 3,000
Feet

Excelsior Mining Arizona, Inc.
Gunnison Copper Project
UIC Permit Application
February 2016

Date	File ID
1/21/16	373-031A

N

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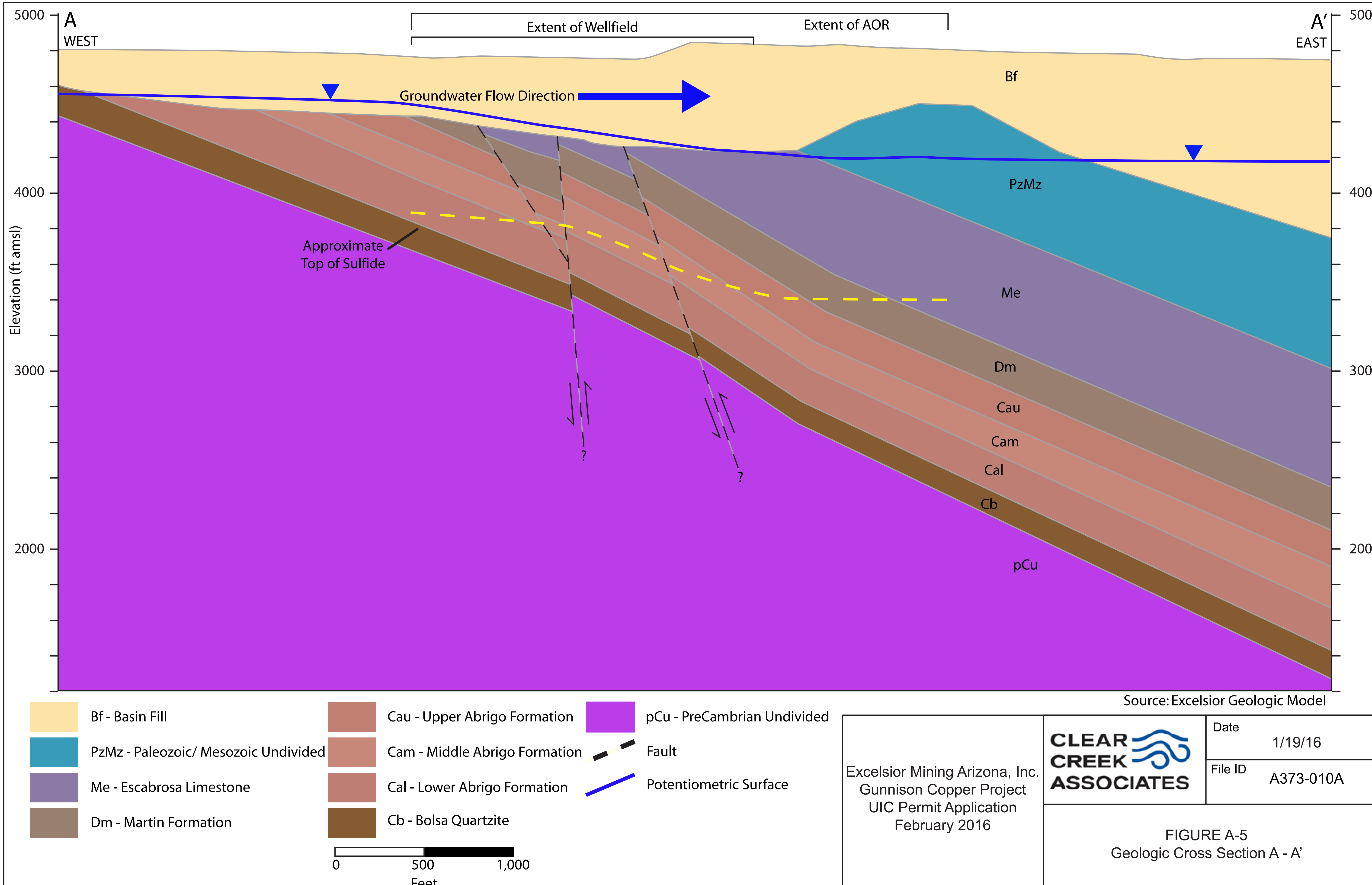
FIGURE A-4
Potentiometric Surface Map



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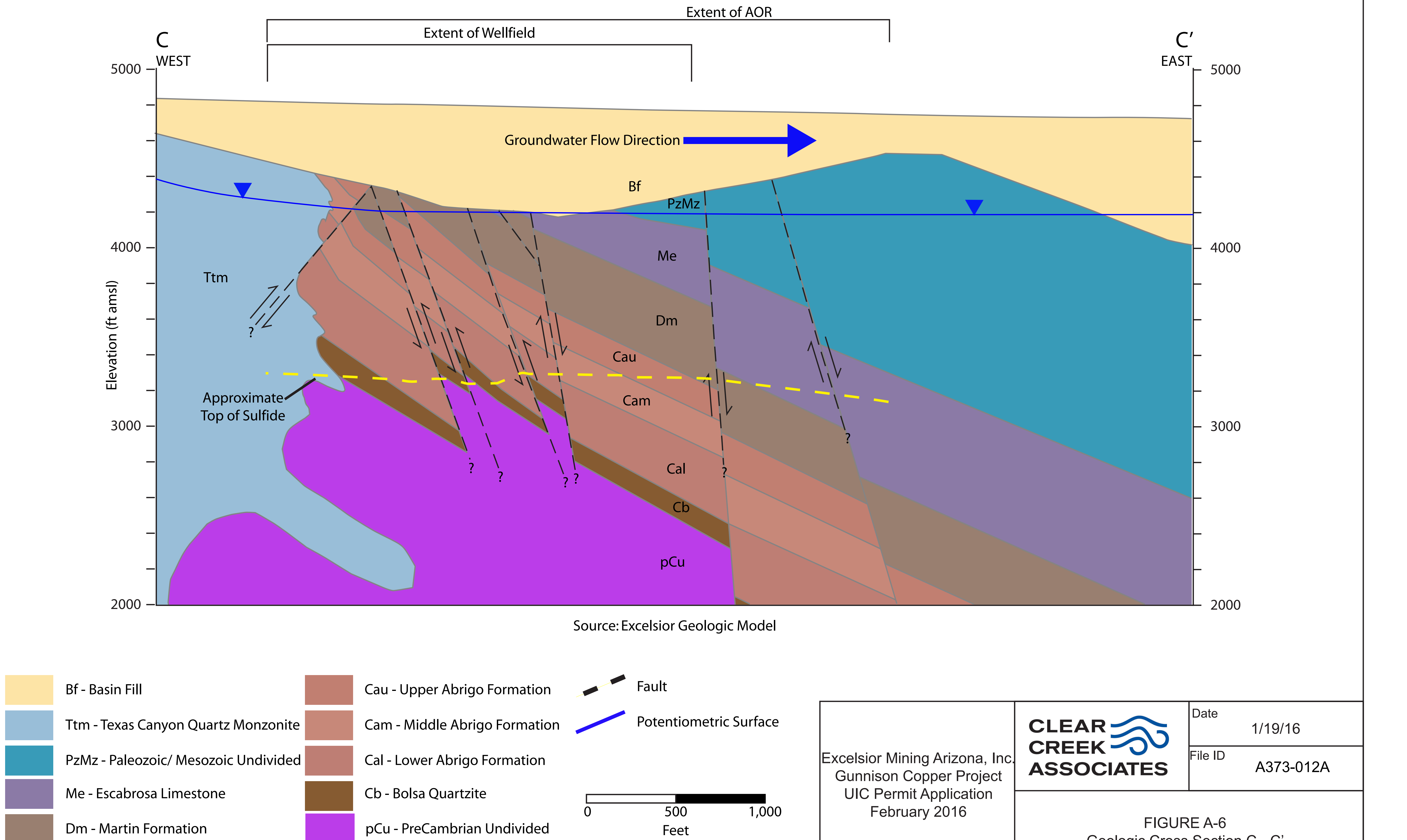
February 2016

CLEAR CREEK ASSOCIATES

Date 1/19/16

File ID A373-010A

FIGURE A-5
Geologic Cross Section A - A'



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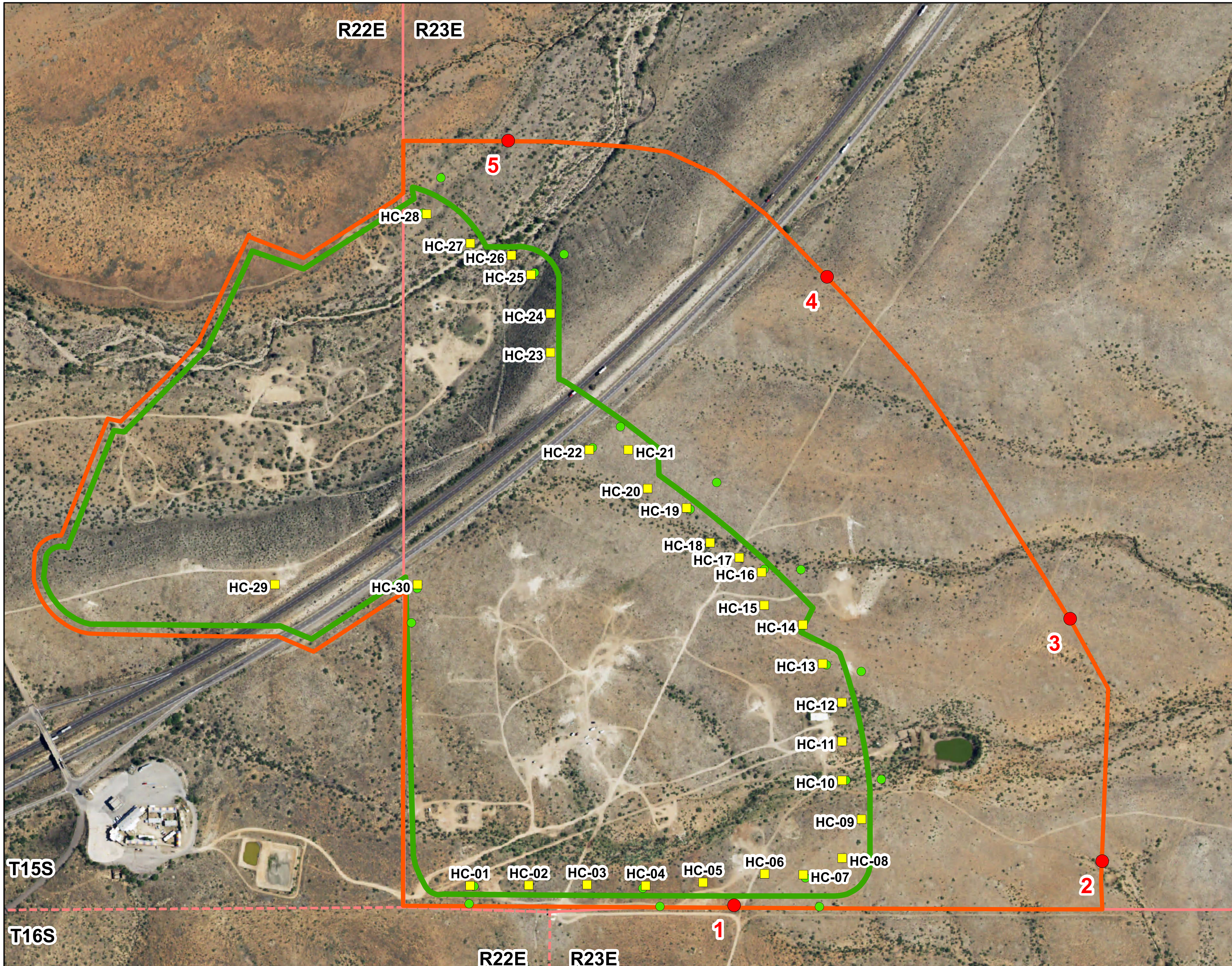
CLEAR CREEK ASSOCIATES

Date	1/19/16
File ID	A373-012A

FIGURE A-6
Geologic Cross Section C - C'



Legend

- Point of Compliance Well
- Hydraulic Control Well
- Observation Well
- Area of Review
- ISR Wellfield

Observation Wells will have same number as associated hydraulic control well.

Example: At HC-1, observation wells will be named:

OW-1-I (inner)
OW-1-O (outer)

0 250 500 1,000
Feet

Excelsior Mining Arizona, Inc.
Gunnison Copper Project
UIC Permit Application
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CLEAR CREEK ASSOCIATES

FIGURE A-7
Area of Review, Point of Compliance, Hydraulic Control, and Observation Well Locations